INVESTIGATION OF WATER QUALITY PARAMETERS AT SELECTED POINTS ON THE TENNESSEE RIVER

Semi - Annual Report for NASA Grant
NGR 01-001-018

June 1, 1972

ALABAMA A. & M. UNIVERSITY

NORMAL, ALABAMA 35762

PROJECT DIRECTOR: Dr. Martin C. Manger

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
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Date: October 4, 1973

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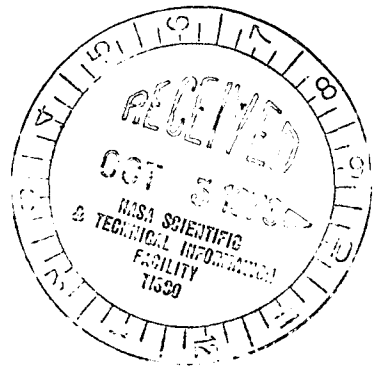
Subject: NASA Document Discrepancy Report 73-369



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Deputy General Manager
Informatics TISCO
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Sincerely,

Barbara Reed

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Deputy General Manager
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SEMI - ANNUAL STATUS REPORT:

Investigation of Thernal and water quality parameters in the vicinity of Widows Creek Steam Generation Plant has been continued as described in the previous report. The accumulated data now respresents a years sampling and a profile of both temperature and water quality parameters can be projected at this location. These data are being futher tabulated, analyzed, and sumerized for presentation at the 1973 Southeastern American Chemical Society Regional meeting in November. A copy of the abstract is attached to this report.

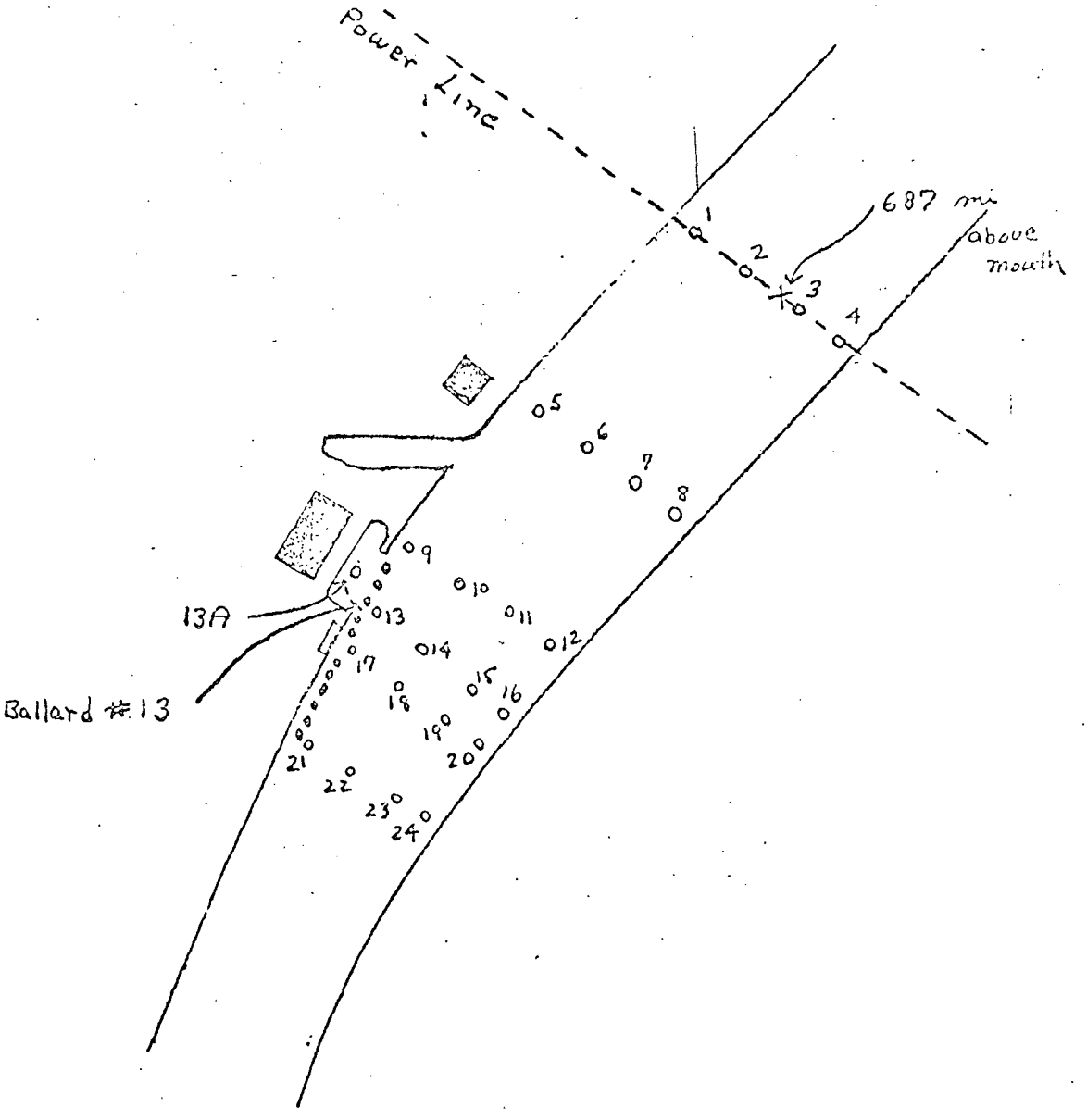
Initial water sampling was carried out at all 24 stations in addition to other selected locations. Analysis of these samples indicated that no significant difference existed in the main body of the river where the current is approximately five knots or more and mixing occurs. Three stations on the main body of the river were selected for extensive water quality analysis in the laboratory. These stations were chosen because they are representative of the areas of the river which are not effected by the plant supply intake water, and receive effluent from the plant. A fourth sample is taken from the outfall bay-station 13A- and is representative of the plant effluent. Station 2 is representative of the river before it is affected by the plant, station 9 is typical of the intake water and station 21 is representative of the water that receives effluent from the plant. At all other stations, temperature profiles of the river are made with measurements at one meter intervals.

Several of the water quality parameters for station 2 are shown in Table 1 and Figure 2. In Figure 2 the inverse relationship between dissolved oxygen (D. O.) and temperature is apparent while the pH values vary only slightly. Other parameters such as Biochemical Oxygen Demand (B. O. D.) and Chemical Oxygen Demand (C. O. D.) were found to vary from 50 ppm to 260 ppm over the

short time period and C.O.D.'s ranged from about 29 to 300 ppm. Total hardness values were found to be in the range of 100 ppm to 140 ppm and silica in the range of 3 ppm. Phosphates and nitrates were found to be present in unmeasurable trace amounts. No heavy metals were detected while minerals such as sodium and magnesium were found to be in the normal range for water in this area. Table, 1 shows typical analysis data from site 2.

A most interesting phenomena is observed in Figure 3 showing the temperature profile at station 17. Temperature differentials of 10^{o} were found to be common at this station while temperature differentials between the effluent bay and average river temperature of 22.5^{o} F. have been observed. The warmer body of water follows a channel along the west bank of the river and is dispersed in the river within a mile of the outfall. Beyond this poing the river temperature appears to be unaltered during periods of high flow and low temperature. However, during periods of normal flow and river temperatures above 50^{o} F the area of temperature differentical becomes visuble to the naked eye. Figure 4 shows the demarkation between the warmer and colder bodies of water as taken from a NASA false color photograph of the area.

During periods of high flow and low temperatures the temperature differential in the river is not readily observable due to mixing.
However, as the ambient temperature increases the stratification taking place becomes more significant. The importance of this becomes evident when fish kills are observed on warm days in the outfall basin..



Sampling Sites at Widows Creek Steam Plant

Figure 1

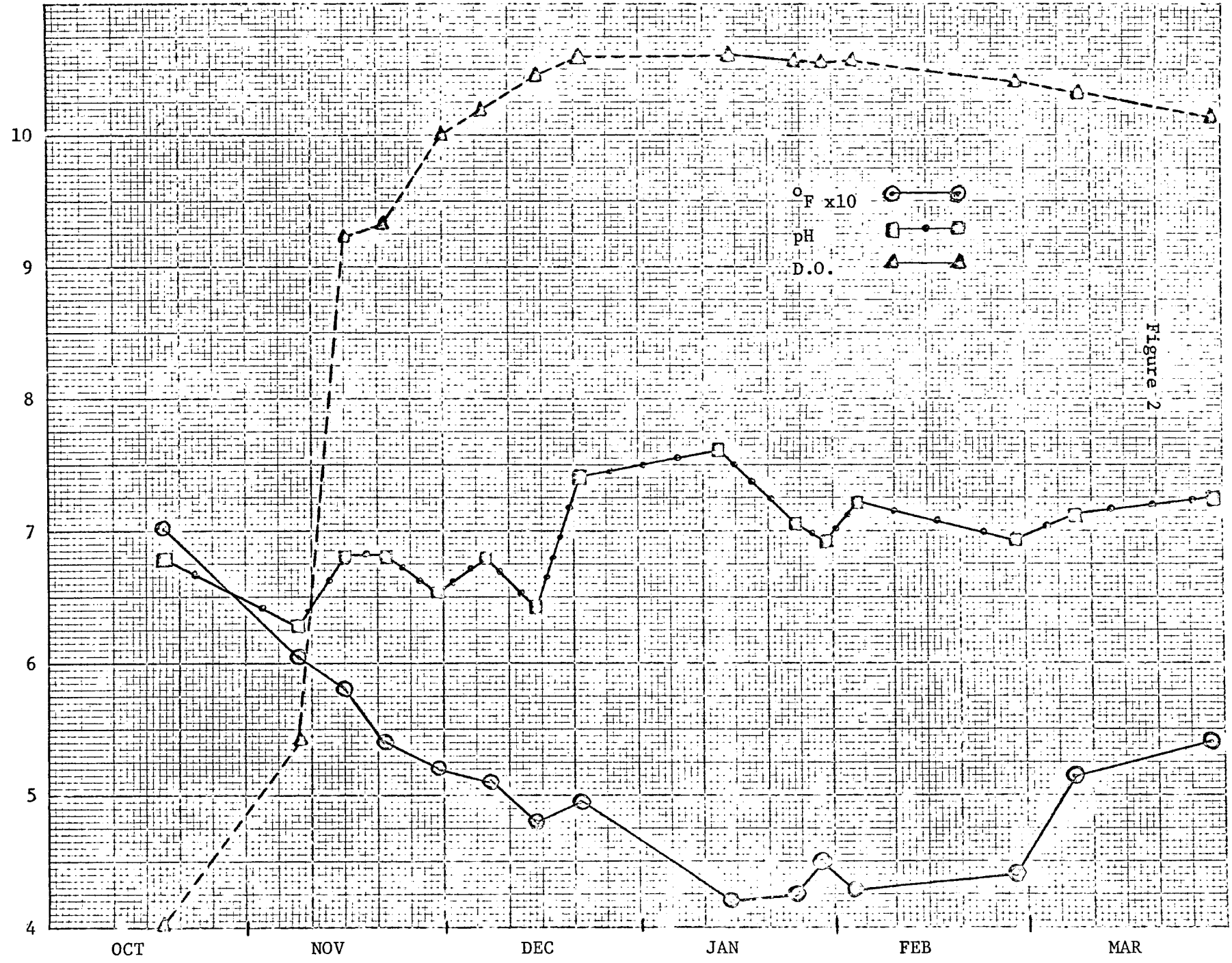


Figure 2

DATA FROM SITE 2

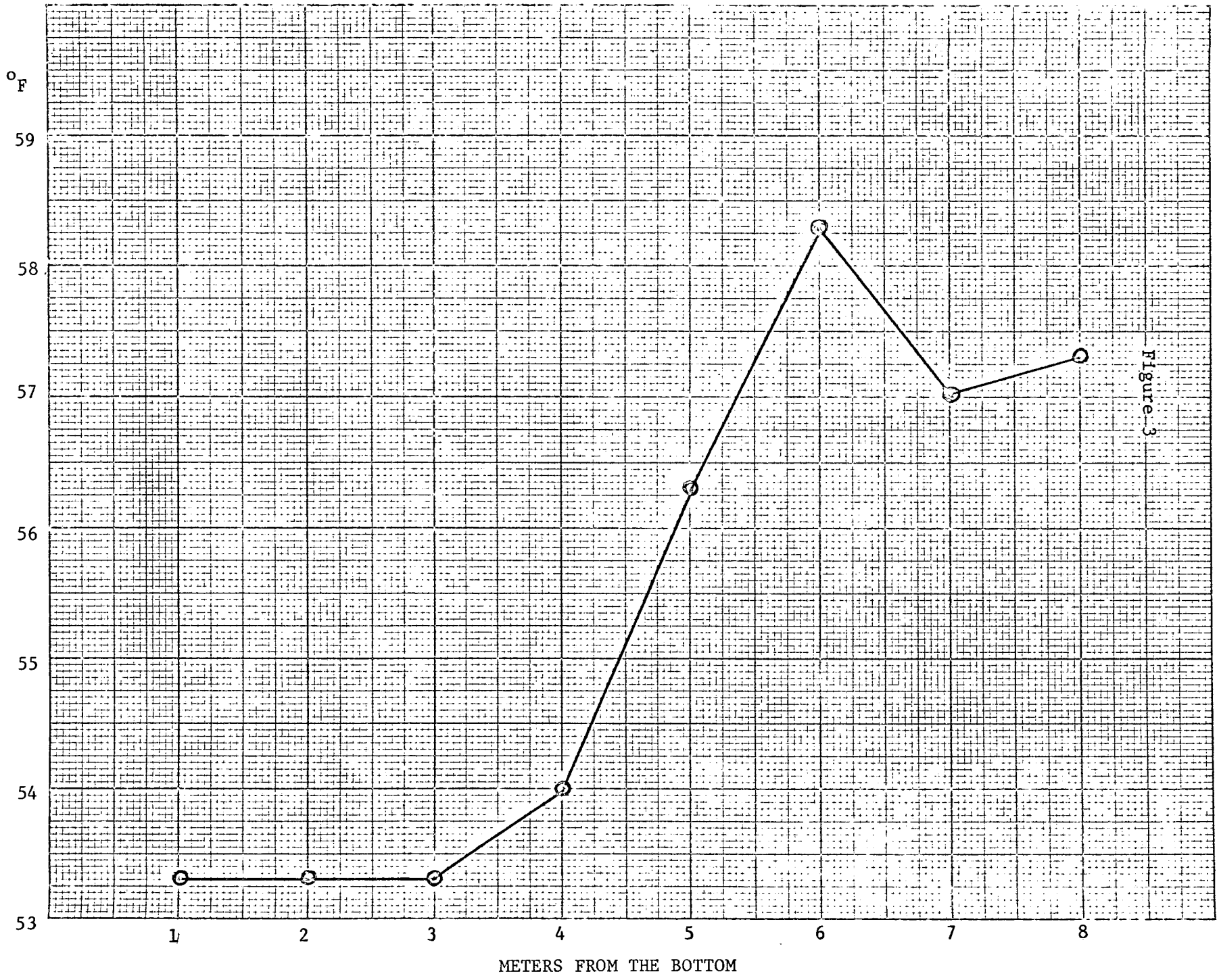
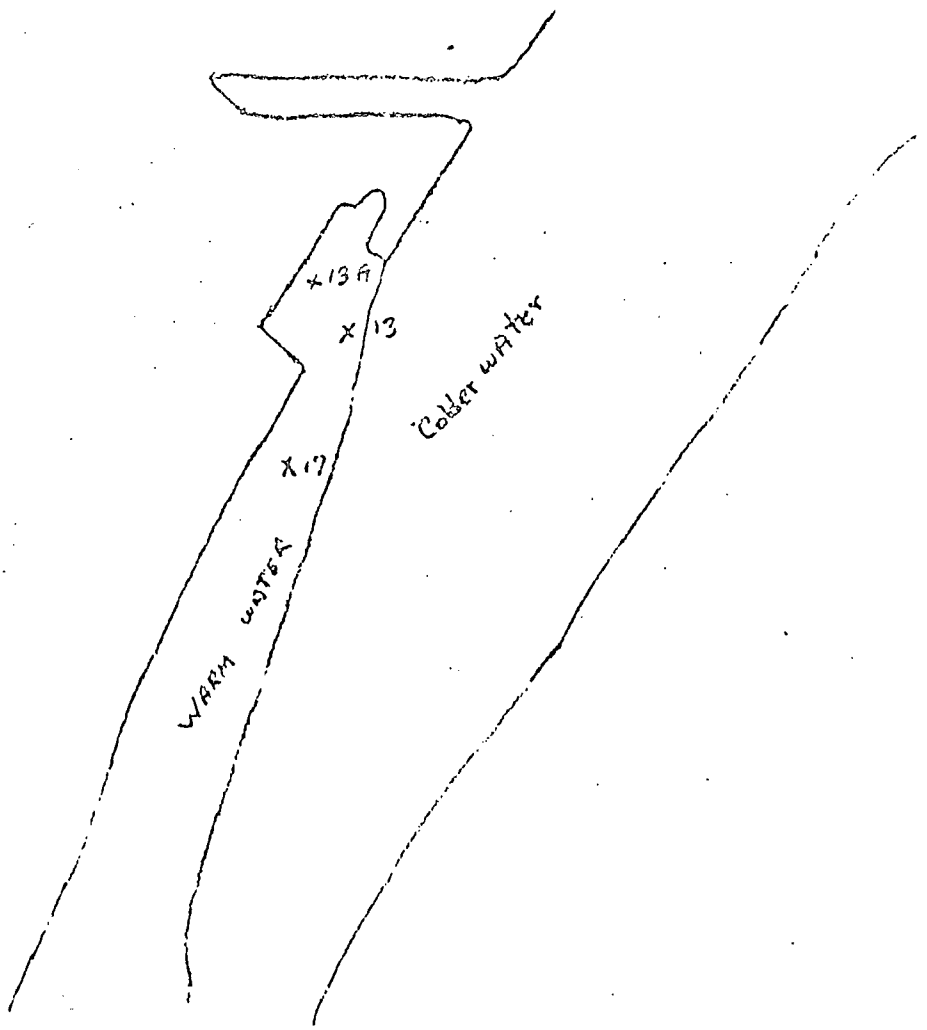


Figure 3

Figure 4



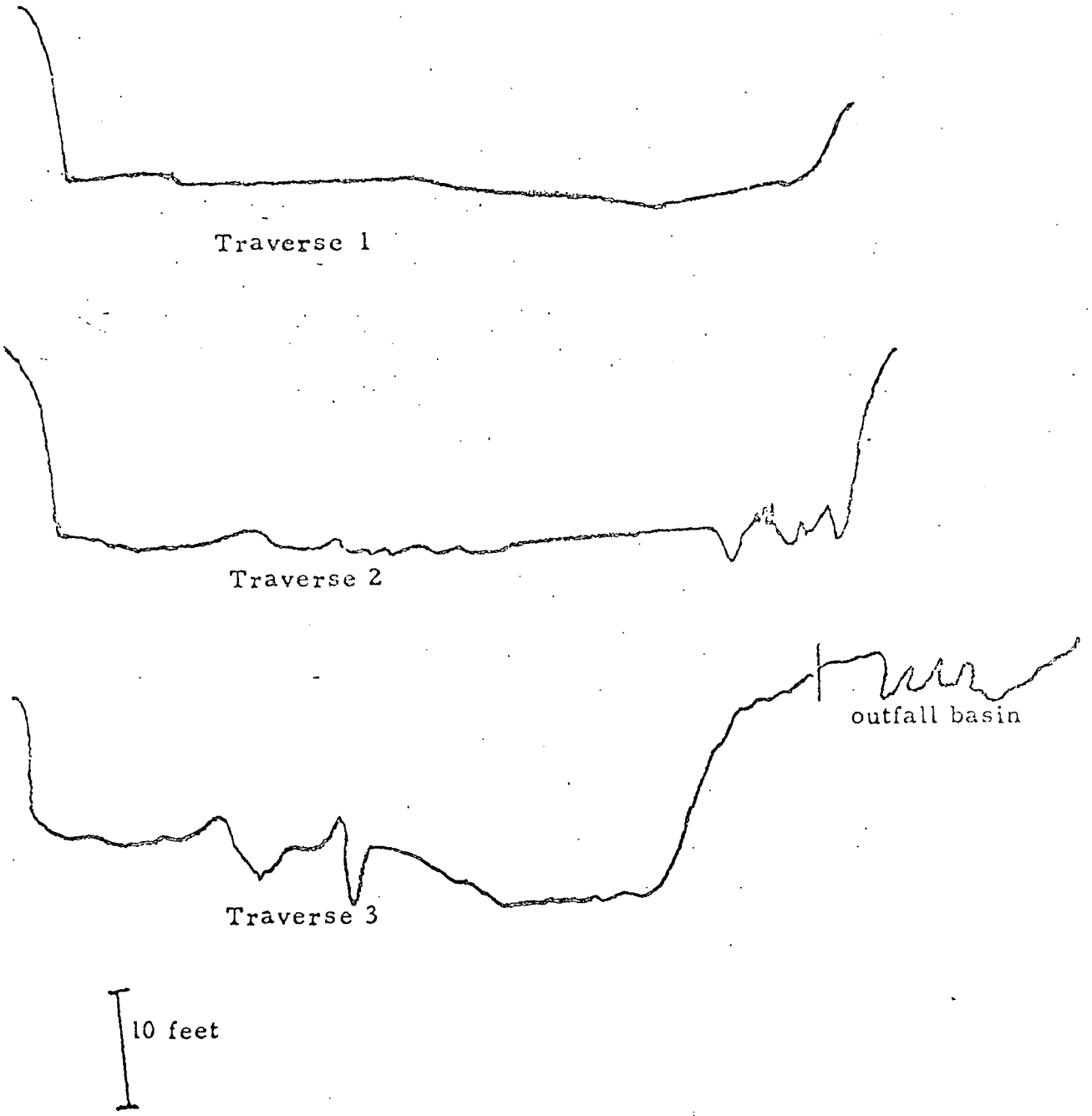


Figure 5
Profile of river bottom

Table 1

ANALYSIS OF TYPICAL WATER FROM

Site # 2

Constituent of Property	Units	ppm
Specific Conductance	1500 Moh	
pH	6.6	
Color	40	
Turbidity		67
Dissolved Solids		114
Silica		3.7
Iron		0.33
Calcium		37
Magnesium		3
Sodium		2.0
Potassium		0.4
Oil and Grease		Trace
Sulfate		5.6
Chloride		3.8
Floride		Trace
Nitrate		Trace
Phosphate		Trace
B.O.D.		100 ppm
C.O.D.		132 ppm
Alkalinity		2.7 ppm
Total Hardness (as Ca-Mg Hardness)		62 ppm

Table 2

Temperature Profile for January 11, 1973

Meters from Bottom °F

Site	1	2	3	4	5	6	7	8	9
1	43.8	43.5	43.8	43.6	43.6	43.6	43.55	-	-
2	41.8	41.6	41.0	41.5	41.5	41.4	41.4	41.4	-
3	43.0	42.6	42.5	43.0	43.0	42.5	43.0	42.6	-
4	42.8	42.5	43.0	43.5	43.0	43.2	43.1	43.1	-
5	42.8	42.6	42.6	42.75	42.6	42.6	42.6	42.6	-
6	42.5	42.5	42.4	43.0	42.8	42.6	42.75	-	-
7	43.0	42.5	42.6	43.0	43.0	42.8	43.0	-	-
8	43.0	42.6	42.8	43.1	43.1	42.5	43.5	-	-
9	42.9	42.6	42.5	42.8	42.8	42.7	42.6	-	-
10	43.0	42.8	42.6	43.0	42.9	42.5	42.75	-	-
11	43.2	43.1	43.2	43.5	43.6	43.4	-	-	-
12	40.5	41.5	41.5	42.0	42.1	41.8	-	-	-
13	42.5	42.3	44.0	44.0	52.2	52.2	53.0	51.5	-
14	45.0	47.5	49.9	50.3	50.1	50.0	49.0	49.0	-
15	44.0	44.0	44.0	44.0	44.0	44.0	43.7	-	-
16	43.4	43.4	43.5	43.7	43.5	43.5	-	-	-
17	45.0	47.5	49.75	50.4	50.3	50.0	49.0	49.0	-
18	44.0	44.1	44.0	44.1	44.0	44.0	43.8	44.0	-
19	42.4	42.2	-	42.6	42.5	42.4	42.3	42.3	-
20	42.6	42.6	42.7	42.8	40.3	-	-	-	-
21	45.5	45.5	46.0	47.2	47.1	47.2	47.3	-	-
22	43.4	43.1	43.0	43.0	43.0	42.6	42.5	42.5	42.5
23	43.0	44.4	44.0	43.9	43.5	43.8	43.5	43.5	-
24	43.3	43.5	43.6	43.7	43.8	43.8	-	-	-
13 A	52.0	52.0	52.0	52.0	40.0	41.0	-	-	-

Temperature Profile Date of Sampling April 3, 1973

Site	Meters from Bottom °F 1	2	3	4	5	6	7	8	9
1	55.00	55.25	55.25	55.25	-	-	-	-	-
2	54.25	54.25	54.00	54.25	54.00	54.25	-	-	-
3	54.25	54.25	54.25	54.25	54.25	54.25	-	-	-
4	55.75	55.75	55.75	55.75	-	-	-	-	-
5	56.00	56.00	-	-	-	-	-	-	-
6	55.25	55.25	55.25	55.25	55.25	55.25	55.25	-	-
7	55.00	55.00	55.00	55.00	55.00	55.00	55.00	-	-
8	54.25	54.25	-	-	-	-	-	-	-
9	55.50	55.50	55.50	55.50	55.50	55.50	55.50	-	-
10	53.75	53.75	53.75	53.75	53.75	53.75	53.75	-	-
11	55.00	55.00	55.00	54.75	54.75	54.75	-	-	-
12	55.00	-	-	-	-	-	-	-	-
13	57.00	56.00	55.75	60.50	60.00	63.25	64.25	-	-
14	55.25	55.25	55.25	55.25	55.25	55.25	55.25	-	-
15	54.75	55.00	55.00	55.00	54.75	54.75	54.75	54.75	-
16	54.50	54.50	54.50	-	-	-	-	-	-
17	57.25	56.50	56.25	56.25	56.25	56.75	56.25	58.25	58.25
18	55.75	55.75	55.75	55.75	55.15	55.25	55.00	55.00	-
19	55.00	55.00	55.00	55.00	55.00	55.00	55.00	-	-
20	55.50	55.50	-	-	-	-	-	-	-
21	55.75	55.75	55.75	55.75	-	-	-	-	-
22	54.75	54.75	54.75	54.75	54.75	54.75	54.75	-	-
23	54.25	54.25	54.25	54.25	54.25	54.25	54.25	-	-
24	55.50	55.50	55.50	55.50	-	-	-	-	-
13A	62.50	62.50	-	-	-	-	-	-	-

Temperature Profile

Date of Sampling 2-27-73

Meters from Bottom ^{o}F

Site	1	2	3	4	5	6	7	8	o
1	45.25	45.25	45.25	-	45.75	-	-	-	-
2	44.00	44.00	44.00	-	44.50	44.50	-	-	-
3	44.50	44.50	44.50	-	45.25	-	-	-	-
4	44.50	44.50	44.75	-	-	-	-	-	-
5	45.75	45.75	45.75	-	-	-	-	-	-
6	44.00	44.00	43.75	-	44.50	-	-	-	-
7	43.00	42.75	42.75	-	42.75	42.75	-	-	-
8	43.75	43.50	-	-	-	-	-	-	-
9	44.75	44.75	44.75	-	45.00	45.00	-	-	-
10	43.50	43.75	43.70	-	44.00	43.75	-	-	-
11	43.00	43.00	43.00	-	43.50	-	-	-	-
12	47.50	47.50	-	-	-	-	-	-	-
13	46.50	44.75	46.50	-	49.00	50.50	-	-	-
14	43.75	44.00	44.00	-	44.75	44.25	-	-	-
15	43.25	43.25	43.25	-	43.75	-	-	-	-
16	44.00	44.00	43.75	-	-	-	-	-	-
17	44.75	45.75	45.75	-	48.25	48.25	50.00	50.00	-
18	43.75	43.50	43.50	-	43.50	43.50	-	-	-
19	43.75	43.75	43.75	-	44.50	44.00	-	-	-
20	44.00	44.00	-	-	-	-	-	-	-
21	47.50	47.50	47.50	-	-	-	-	-	-
22	44.25	44.25	44.25	-	44.75	46.50	47.00	44.25	
23	43.45	43.75	43.75	-	44.40	44.00	-	-	-
24	43.75	43.75	43.75	-	-	-	-	-	-
13A	53.50	53.75	53.50	-	-	-	-	-	-

Temperature Profile Date of Sampling 3-27-73

Meters from Bottom °F

Site	1	2	3	4	5	6	7	8	9
1	54.0	54.25	54.50	-	54.75	54.75	-	-	-
2	53.25	53.25	53.25	-	53.25	53.50	53.25	-	-
3	54.25	54.25	54.25	-	54.00	54.00	54.25	-	-
4	53.75	54.00	54.00	-	-	-	-	-	-
5	54.25	54.25	54.25	-	-	-	-	-	-
6	54.00	53.75	54.00	53.75	53.75	53.75	-	-	-
7	53.00	53.25	53.25	-	53.00	52.75	52.50	-	-
8	53.00	53.00	53.00	-	-	-	-	-	-
9	54.00	54.00	54.00	-	53.75	53.75	53.75	-	-
10	53.50	53.50	53.50	-	53.50	53.25	53.25	53.25	53.00
11	53.50	53.50	53.50	-	53.50	53.50	53.25	-	-
12	53.25	53.25	-	-	-	-	-	-	-
13	55.00	56.00	56.50	-	-	-	-	-	-
14	53.00	52.75	52.75	-	52.75	52.75	52.75	-	-
15	53.50	53.50	53.75	-	53.75	53.75	53.75	-	-
16	54.00	54.00	54.00	-	-	-	-	-	-
17	55.25	55.25	55.25	-	58.25	58.25	58.25	58.25	58.75
18	56.75	56.75	56.75	-	57.75	57.75	57.75	57.75	58.00
19	57.25	57.25	57.25	-	56.25	56.25	-	-	-
20	59.75	59.75	59.75	-	-	-	-	-	-
21	53.50	53.50	53.50	-	57.00	-	-	-	-
22	56.25	56.75	56,25	-	57.00	57.00	57.00	57.00	57.00
23	55.00	55.00	55.00	-	55.00	55.00	55.00	55.00	-
24	54.75	54.75	54.75	-	-	-	-	-	-
13A	60.50	60.75	60.75	-		-	-	-	-